INDIAN INSTITUTE OF MATERIALS MANAGEMENT
Post Graduate Diploma in Materials Management
PAPER – 18 C
OPERATIONS RESEARCH.

June 2014

DATE: 21.06.2014   Max. Marks: 100
TIME: 2.00 p.m to 5.00 p.m.   Duration: 03 Hrs.

Instructions:
1. The question paper is in two parts.
2. Part A is compulsory. Each question carries one mark   Total 25 marks
3. In part B answers 5 questions out of 8. Each question carries 15 marks.   Total 75 marks

_____

PART A   25 marks

(Compulsory -Each question carries 1 mark)

Q. 1. Select the correct answer from the multiple choices.

i) ABC analysis is based on

    a) Unit price   b) Annual consumption value

    c) Stock value   d) annual purchase value

ii) A linear programming model consists of n variables and m constraints. The number of basic variables is

    a) n   b) m   c) n-m   d) m-n

iii) Minimum number of corners required for a loop in a transportation problem is

    a) 2   b) 4   c) 6   d) 8

iv) Monte Carlo is associated with

    a) Sequencing   b) Queuing theory

    b) Simulation   d) Game theory

v) Which of the following is not a characteristic of a queuing model?

    a) Arrival pattern   b) Jockeying

    c) Service patterns   d) Discipline

Q.2. Fill in the blanks. (Please do not reproduce the statement)

a) When the slope of the objective function and the constraints are different there exists a _____ solution.

b) Condition of a LPP where some of the basic variables have zero value is said to _____.

c) A transportation problem is said to be _____ if the aggregate supply does not equal to aggregate demand

d) All dummy rows/columns must have elements equal to _____

e) In a simplex maximization problem to convert a constraint into an equation a _____ variable is added.

f) In a negotiation of a contract _____ theory can be used to predict the outcomes.

g) The float of all the activities in the critical path of a project network is _____

h) In a game theory _____ rule is used to reduce the matrix to a 2x2 size.

i) Simulation needs a _____ component.

j) Variation in demand and lead time is taken care of by _____ stock

Q.3. Please state True of False

a. A LPP can have only two decision variables.

b. The objective function and constraints of a LPP must be linear.

c. The dual to the dual of an LPP is the primal LPP itself.

d. VAM cannot be used to find an initial solution to a transportation problem if the transportation problem is unbalanced.

e. PERT network is deterministic in nature.

f. An assignment problem where one assignment is prohibited can be solved by deleting assignment.

g. Arrival of passengers from aircraft at an airport is an example of individual arrival of customers.

h. Every sequencing problem must have a unique and optimal solution.

i. Averaging the observations yields a better estimate of the outputs of simulation model.

j. An integer programming problem is a linear programming problem with all decision variables restricted to integer values.

PART B   75 marks

(Attempt any 5 Questions)

Q.4. Use simplex method to find the maximum value of

$Z = 3X1 + 2X2 + 5X3$

Subject to the constraints

$X1 + 2X2 + 2x3 \leq 8$

$3X1 + 2X2 + 6X3 \leq 12$

$2X1 + 3X2 + 4X3 \leq 12$

Where $X1, X, X3 \geq 0$ (15 marks)

Q.5. The products of 5 factories A, B, C, D, E are to be transported to five warehouses1, 2, 3, 4 &5.
The unit transportation cost from each factory to each warehouse is tabulated below.

	1	2	3	4	5	supply
A	80	69	103	64	61	12
B	47	100	72	65	40	16
C	16	103	87	36	94	20
D	86	15	57	19	25	8
E	27	20	72	94	19	8
Demand	16	14	18	6	10	

a) Determine the optimum solution to minimize the costs   .   (10 marks)
b) Calculate the minimum transportation costs.   (3 marks)
c) Comment on the uniqueness of the solution.   (2 marks)

Q.6. Data on the operating costs per year and resale prices of a piece of equipment whose purchase price is Rs10000.00 is given below.

Year	1	2	3	4	5	6	7
Operating cost	1500	1900	2300	2900	3600	4500	5500
Resale value	5000	2500	1250	600	400	400	400

When should the machine be replaced?   (15 marks)

Q.7. The following table gives activities and time taken by each of these activities.

Activity nodes	to	tm	tp
1-2	2	4	6
1-3	6	6	6
1-4	6	12	24
2-3	2	5	8
2-5	11	14	28
3-4	15	24	45
3-6	3	6	9
4-6	9	15	27
5-6	4	10	16

a) Draw the network diagram   (4 marks)

b) Identify the critical path and its duration.   (3 marks)

c) Calculate variance for each of the activities.   (3 marks)

d) Calculate earliest start time, earliest finish time, latest start time, latest finish time and float
for each of the activities.   (5 marks)

Q.8. a) Customers arrive at the first class ticket counter of a theatre at a rate of 12 per hour. There is
one clerk serving the customers at a rate of 30 per hour.

i)   What is the probability that the system is idle?

ii)   What is the probability that there are more than 2 customers in the counter?

iii)   What is the probability that there is no customer waiting to be served?

iv)   What is the probability that a customer is being served and nobody is waiting?

(12 marks)

Q.8. b) What are the operating characteristics of a queuing system?   (3 marks)

Q.9. Cost of doing five jobs by five typists is given below.

Typists	Job1	Job2	Job3	Job4	Job5
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

Assign the jobs to typists in such a way that the total cost is the minimum. Also find the total cost of typing the jobs.   (15 marks)

Q.10. A company manufactures around 150 mopeds. The daily production varies from 146 to 154 depending on the availability of raw materials and other working conditions.

Production per day	Probability
146	0.04
147	0.09
148	0.12
149	0.14
150	0.11
151	0.10
152	0.20
153	0.12
154	0.08

Finished mopeds are transported in a specially arranged lorry accommodating 150 mopeds. Using the random numbers 80,81,76,75,64,43,18,26,10,12,65,68,69,61,57 simulate the process to find out

a) What will be the average number of mopeds waiting in the factory?
b) What will be the average number of empty spaces in the lorry?   (15 marks)

Q.11. Write short notes on any five.

    a)   Unboundedness in LPP

    b)   Sensitivity analysis

    c)   Markov chains

    d)   Sequencing n jobs on three machines

    e)   Re-order level

    f)   Dominance rule   (5x3 = 15 marks)

****